

**DESCRIPTION OF MATURE LARVA AND NESTING
BEHAVIOR OF *PSEUDOSCOLIA MARTINEZI* SUÁREZ
(HYMENOPTERA: SPHECIDAE)**

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Abstract.—The mature larva of *Pseudoscolia martinezi* Suárez, 1981, is described, and details are offered on adult nesting behavior. The main morphological characters of the larva are mandibles tridentate, well-developed galeae, spinnerets bigger than labial palpi, and the appearance of the epipharynx, which is similar to that of the known larvae of the *Cercerini*. The females of this species nest in small aggregations of 5–10 individuals, leveling the mound during the excavation of nests. They show variability in the practice of temporary closures, with some females leaving the nest open while others close the burrow during provisioning. Adult females capture Halictidae as prey.

The subfamily Philanthinae includes more than 1,000 species distributed among 11 genera (Bohart and Menke, 1976), making it one of the most important subfamilies within the Sphecidae. Most studies on the biology and preimaginal stages of the Philanthinae deal with species of *Philanthus* and *Cerceris*, two genera which are extensively distributed. Data on the biology and preimaginal stages of other genera are scanty but valuable, because in some cases their systematic position is not well established. Such is the case with *Eremiasphecium* Kohl, *Philanthinus* Beaumont, *Listropygia* Bohart, *Odontosphex* Arnold, and the genus dealt with here: *Pseudoscolia* Radozskowski.

Twenty species of *Pseudoscolia* are now known, eighteen of which range from northwestern Africa to southwestern USSR. Of the two remaining species, one is found in Mongolia and the other in arid areas in the southeast Iberian Peninsula (*P. martinezi*). In general, the species of *Pseudoscolia* have a very restricted distribution, occupying desert areas of the Palearctic Region, where they constitute typical elements of the eremic fauna.

Very little has been published on the biology of *Pseudoscolia*. The only sound information was offered by Beaumont (1949), concerning a male of *Halictus* Latreille (Apoidea: Halictidae) as the prey of *Pseudoscolia tricolor* (Giner Marí).

In this article, the mature larva as well as several aspects of the nesting behavior of *Pseudoscolia martinezi* are described. Observations were conducted from 18–25 June, 1989 in the Rambla of Tabernas, Almeria, Spain.

DESCRIPTION OF MATURE LARVA

The description of the larva is based on two specimens. The following abbreviations are employed in the description: d = diameter, h = height, l = length, w = width.

General appearance

Small fusiform body ($l = 7$ mm, $w = 2.1$ mm). Pleural lobes well-developed. Posterior end protuberant, the anal lobes forming a tubular projection on which the anus is located apically (Fig. 2). Anal lobes similar in size, the subanal being slightly bigger.

Whole surface of integument spinulose, the spinules ($l = 5\text{--}10$ μm) being more numerous toward the anterior end of the body. Scattered setae ($l = 20$ μm), more numerous in the posterior end.

Prothoracic spiracles ($d = 75$ μm) slightly bigger than the rest ($d = 60\text{--}65$ μm). Walls of atrium lined with lengthened irregular polygons (Fig. 1); opening to subatrium unarmed.

Whitish coloration, the spiracles appearing slightly brownish; mandibles, maxillary and labial palpi, galeae and antennae also of this brown color.

Head

Slightly higher than wide ($h = 0.79$ mm, $w = 0.76$ mm) (Fig. 3). Antennal orbits circular ($d = 55$ μm), inconspicuous; antennae moderately long ($l = 39$ μm , maximum $d = 19$ μm). Coronal suture well-developed ($l = 0.24$ mm); parietal bands absent.

Head capsule with scattered punctures, which are denser on the clypeus; small setae emerge from some of these punctures.

Mouthparts

Labrum ($w = 0.34$ mm) with even anterior edge, and with a faint notch in the center (Fig. 4a); some setae appear on the apical third and several sensilla on margin. Epipharynx spinulose on the anterior edge, lateral margins and basal area, a naked area appearing on the medial part (Fig. 4b). Sensory areas with 6 pores ($d = 5$ μm) on each side; some sensillae also appear on the central part of the anterior edge.

Mandibles thin ($w = 0.195$ mm, $l = 0.37$ mm) with three teeth on the internal margin and with a seta at the base (Fig. 3).

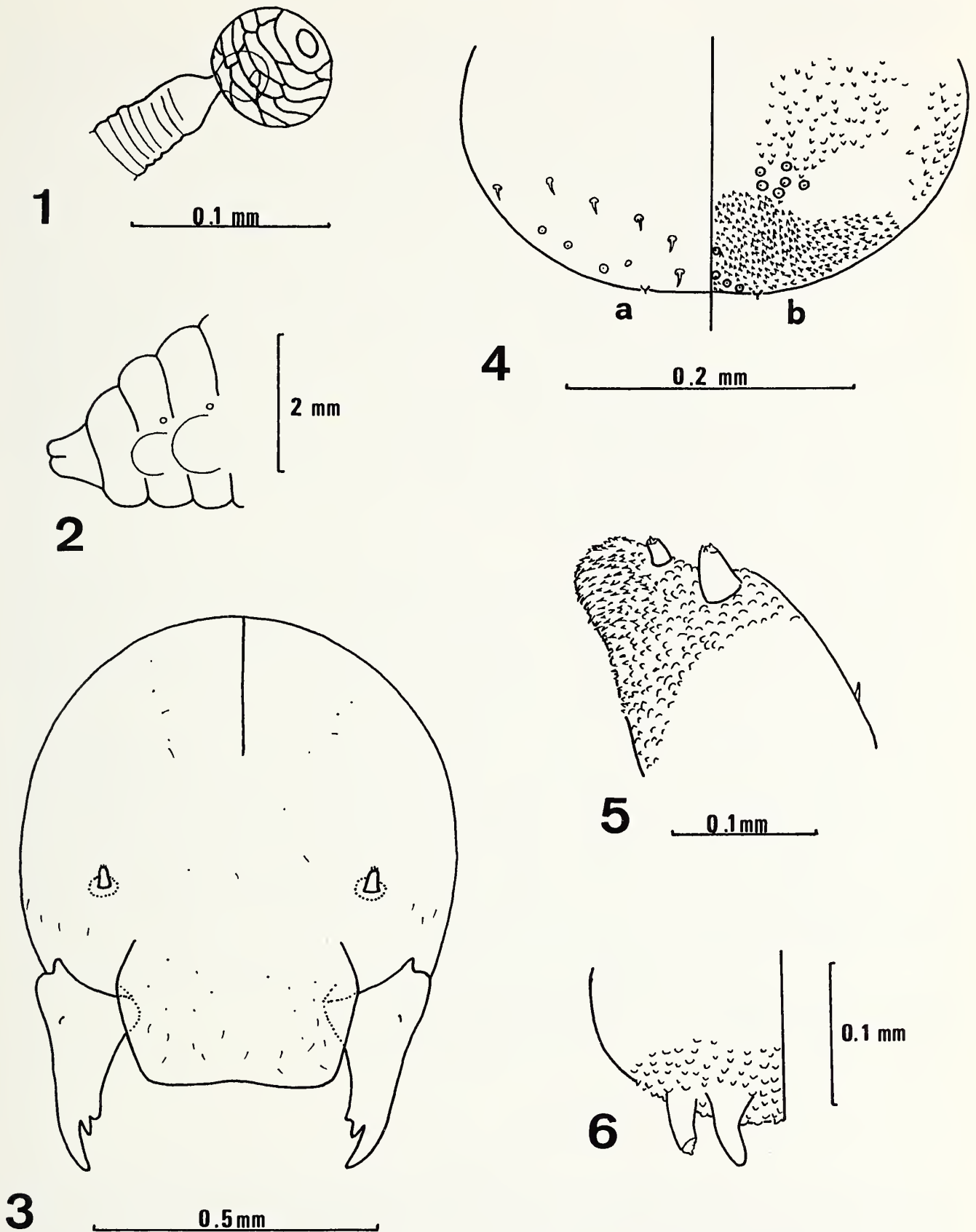
Maxillae, as in the other Philanthinae, projecting as large, free lobes. Lacinal area spinulose (Fig. 5), some setae appearing on ventral face. Maxillary palpi ($l = 45$ μm , $d = 25$ μm) much bigger than galeae ($l = 20$ μm , $d = 12$ μm), which are very thin.

Labial palpi ($l = 45$ μm , $d = 25$ μm) smaller than the spinnerets ($l = 55$ μm , $d = 15$ μm), which clearly exceed them (Fig. 6).

NESTING BEHAVIOR

Nesting area

The studies on nesting behavior were carried out in the Rambla de Tabernas, on the road that goes through the western spurs of the sierra of Alhamilla. The area belongs to the Almeriense sector, of the Murciano-Almeriense province of the Mediterranean region. It has an approximate altitude of 275 m, and the annual precipitation is lower than 300 mm.



Figs. 1–6. Mature larva of *Pseudoscolia martinezi* Suárez, 1981. 1. Spiracle (atrium and subatrium). 2. Last four segments of the abdomen (lateral view). 3. Head (frontal view). 4a. Labrum. 4b. Epipharynx. 5. Right maxilla (dorsal view). 6. Labium (oral surface, right half).

Nesting behavior

The females nested in small aggregations with from five to 10 individuals occupying areas of about two square meters, although some females established their nests in isolation. Nests were located in horizontal sandy areas, with sparse vegetation, although the entrances of some nests were placed near small plants.

The females became active at about 0930, becoming much less active from 1500 onward. They spent the night inside the nests, closing them from inside.

Females used their forelegs to throw sand backwards under the body. Periodically, the female went outside to remove the accumulated sand from the burrow, and this sand was scattered in such a way that it did not accumulate near the entrance. The female moved backwards to level the ground, with her head towards the entrance, about 6 cm away from the opening of the nest, and returned to the entrance while raking sand. The operation was repeated several times before the female reentered the nest and continued excavation of the main burrow, only raking sand when going to the entrance. Burrows showed a slight slope at the beginning, but after 6–8 cm they sloped strongly downward at an angle of 55–65° until a depth of 20–25 cm was reached, where the cells were located.

With respect to temporary closures, five females left the nest open during provisioning, while the other two made temporary closures. If the entrance remained open during provisioning trips, the wasp entered directly into the nest with her prey. If there was a temporary closure, the wasp opened and entered the nest, releasing the prey inside near the entrance. Immediately, she then turned around, seized the prey by its antennae with her mandibles and dragged it into the burrow.

Four nests were excavated. Three of them had a closed cell with the larva in different stages of development, while the other one only had some prey. In two of the three nests in which a larva was found, some prey were also found stored in the main burrow, which indicates that the nests are multicellular. Because this species seems to reach its peak activity (at least in the area studied) towards the end of June and the beginning of July, the excavated nests were probably recently dug, which would explain their relatively simple structure.

Ten prey were taken from nests, all of them bees belonging to the family Halictidae:

- Halictus (Vestitohalictus) vestitus* Lepeletier: 1♂.
- Lasioglossum (Evyllaesus) immunitum* (Vachal): 1♂.
- Lasioglossum (Evyllaesus) planulum* (Pérez): 2♀♀.
- Nomiodes minutissima* (Rossi): 4♀♀.
- Nomiodes variegata* (Olivier): 2♀♀.

Prey may have been captured on plants, since it was common to see females fly over the bases of *Salsola webbii* (Moq. 1840) (Chenopodiaceae). The females seemed to show a preference for this plant, and in fact, when Suárez (1981) described the species, he commented on the fact that most of the specimens appeared at *Salsola* sp. and did not visit other species in the same area.

Natural enemies

In the nesting area several females of *Pterella melanura* (Meigen) (Diptera: Sarcophagidae) perched on little stones and branches and pursued prey-laden females.

These miltogrammine flies are possibly cleptoparasites of *Pseudoscolia martinezi*, although no *Pterella melanura* larvae were found in the nests.

DISCUSSION

The larvae of Philanthinae were characterized by Evans (1957, 1959) on the basis of a reduction in the size of the galeae, an increase in the number of spinules of the tegument, slender mandibles and a tubular-shaped anal segment. All these characters appear in the larva of *Pseudoscolia martinezi*, which, however, shows certain unique characters among the Philanthinae: the very small notched shape of the labrum and walls of spiracular atrium with lengthened polygons.

Both the tridentate mandibles, a character that *P. martinezi* shares with the larvae of *Philanthus*, and the very conspicuous galeae, shared with those of Cercerini, were considered as primitive by Evans (1959, 1964). However, *P. martinezi* has well developed spinnerets, which are longer than the labial palpi. This trend towards a greater development of the spinnerets was pointed out by Evans (1964) as a specialized character, and is shared by *P. martinezi* and by the Cercerini. Also, the epipharynx of *P. martinezi*, with a considerable area medio-basally devoid of spinules or papillae, is similar to that appearing in Cercerini (in *Philanthus* and Aphilanthopsini most of the surface of the epipharynx is spinulose). The fact that a specialized character, such as the strong development of the spinnerets, is shared by *P. martinezi* and the Cercerini accords with the opinion of Bohart and Menke (1976), based on the morphology of the adults, that the Cercerini and *Pseudoscolia* evolved from a common ancestor.

The leveling of soil during excavation of the nest seems, for the moment, to be the only specialized trait observed in the nesting behavior of *P. martinezi*. Like *P. tricolor* and many other Philanthini, they capture bees as prey, whose use seems to be ancestral in the Philanthinae. Most of the females of *P. martinezi* left the nest open during provisioning, although some cases were observed in which temporary closures were made. Although this behavioral trait is sometimes characteristic of each species, cases have been observed in which the occurrence of temporary closures varies, even among individuals within the same aggregation (Evans, 1966; Evans and O'Neill, 1988; Kurczewski, 1969, 1982; O'Neill, 1990). The intra-population variation observed suggests that this trait is of no value for establishing relations with other genera.

ACKNOWLEDGMENTS

We wish to thank T. Pape (Zoologisk Museum Copenhagen, Denmark) for the identification of sarcophagids. We are also indebted to J. Alcock (Arizona State University), A. Hook (St. Edward's University) and K. M. O'Neill (Montana State University) for reviewing the manuscript. Grants from the Conselleria de Cultura, Educació i Ciència de la Generalitat Valenciana and Fauna Ibérica (Project PB87-0397) supported the study.

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Received 4 June 1990; accepted 18 December 1990.